Radiofrequency Use and Management

Impacts From the World Administrative Radio Conference of 1979

Summary

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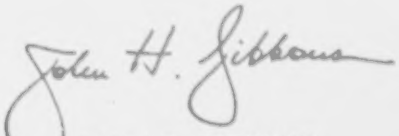
Foreword

This summary presents the major findings of an assessment requested by the Senate Committee on Commerce, Science, and Transportation to evaluate the impacts on the United States of key decisions taken at the general World Administrative Radio Conference (WARC-79) and to consider options for preparation and participation in future international telecommunication conferences. It reflects congressional concern for the adequacy of existing machinery and procedures for U.S. policymaking and preparation for such conferences.

WARC-79 and related international conferences and meetings demonstrate that contention for access to the radio spectrum and its important collateral element, the geostationary orbit for communication satellites, presents new and urgent challenges to vital U.S. national interests. The growing differences among nations over the use of the radio spectrum and related satellite orbit capacity are reflected in the Final Acts of WARC-79 which will be submitted to the U.S. Senate in January 1982, for advice and consent to ratification.

Given the complexities of spectrum management in a changing world environment and the increased importance of telecommunications to both developed and developing nations, it is unlikely that traditional U.S. approaches to these issues will be sufficient to protect vital U.S. interests in the future. Problems require strategies not yet developed or tested.

OTA acknowledges with thanks and appreciation the advice and counsel of the panel members, contractors, other agencies of Government, and individual participants who helped bring the study to completion.



JOHN H. GIBBONS
Director

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Radiofrequency Use and Management: Impacts From the World Administrative Radio Conference of 1979 Advisory Panel

Thomas E. Nelson, *Chairman*
Former Director, Office of International Telecommunications Policy
Department of State

Ambassador Jacob Beam
Head of the U.S. Delegation to the 1973 Plenipotentiary Conference of the International Telecommunication Union

Nolan Bowie
Former Executive Director
Citizens' Communications Center

Paul Dembling
Former General Counsel
National Aeronautics and Space Administration

John M. Eger
Former Acting Director
Office of Telecommunication Policy

James C. Fletcher
Former Administrator
National Aeronautics and Space Administration

Walter R. Hinchman
Former Chief
Common Carrier Bureau
Federal Communications Commission

Harvey J. Levin
Professor, Department of Economics
Hofstra University

Edgar T. Martin
Former Engineering Manager
Broadcasting Service
U.S. Information Agency

Ithiel De Sola Pool
Professor, Department of Political Science
Massachusetts Institute of Technology

Raymond E. Spence
Former Chief Engineer
Federal Communications Commission

M. Jon Vondracek
Director of Communications
Center for Strategic and International Studies
Georgetown University

Grover M. Yowell
Rear Admiral, U.S. Navy (Retired)
Former Manager
Navy Space Project of Naval Electronic Systems Command

NOTE: The Advisory Panel provided advice and comment throughout the assessment, but the members do not necessarily approve, disapprove, or endorse the report for which OTA assumes full responsibility.

Radiofrequency Use and Management: Impacts From the World Administrative Radio Conference of 1979 Project Staff

John Andelin, *Assistant Director, OTA*
Science, Information, and Natural Resources Division

Stephen E. Doyle* and Sam Hale,** *Program Manager*
Communication and Information Technologies Program

Raymond B. Crowell, *Project Director*

Administrative Staff

Liz Emanuel Shirley Gayheart Jeanette Contee

Contractors

J. D. Barnla
Philip S. Cook
Future Systems Inc.
William Hatfield
Kappa Systems Inc.
John J. Kelleher
Susan Stocker
Telecommunications Systems

OTA Publishing Staff

John C. Holmes, *Publishing Officer*

John Bergling Kathie S. Boss Debra M. Datcher Joe Henson

*Program Manager until March 1981.
**Interim Program Manager after March 1981.

Radiofrequency Use and Management

Background of Study

The Senate Committee on Commerce, Science, and Transportation requested that the Office of Technology Assessment (OTA) determine the impacts on the United States of decisions negotiated at the general World Administrative Radio Conference (WARC-79), and consider options for preparation and participation in future international telecommunication conferences. The request reflects congressional concern for the adequacy of existing machinery and procedures for U.S. telecommunication policymaking and preparation for international telecommunication conferences. It also reflects an awareness of the vital and growing role that telecommunication plays in our society and our dependence on the radiofrequency spectrum.

The purpose of this study was to examine WARC-79 in a comprehensive way—describing U.S. preparations and involvement, and the impact of the conference. However, no attempt was made to examine all issues and aspects of WARC-79, but rather to focus on certain important ones and analyze their consequences for the United States. The study considered alternative structures, procedures, and strategies to improve frequency spectrum planning and management to assure the United States of continued satisfaction of its commercial, Government, and national security requirements for frequency spectrum and geostationary satellite orbit locations.

WARC-79 was convened by the International Telecommunication Union (ITU) in an effort to reach global agreement on the revised international arrangements necessary for efficient and interference-free use of the radiofrequency spectrum. The Final Acts of the conference, which will be submitted to the U.S. Senate for advice and consent to ratification, will constitute the "radio regulations, Geneva, 1979" and enter into force on January 1, 1982 for those countries that have formally adopted the Final Acts. WARC-79 was of special importance because of the broad scope of its agenda, which included most of the major arrangements relating to radio, and because it was the first *general* administrative radio conference since 1959 and therefore included many developing countries that had won their independence in the intervening two decades.

The telecommunication systems of the United States are the most sophisticated, efficient, and all-encompassing in the world. These systems are a vital element of our economic strength and security; they are an essential part of our culture. Other nations, recognizing the key role that telecommunications play in national and international affairs, are constantly striving to gain access to telecommunication technology. Highly industrialized nations seek to surpass the United States in technological inventiveness and in the practical exploitation of the many telecommunication subsystems that make up a modern "information society."

As a leader in communication technology, the United States has been able to develop domestic telecommunication systems in large measure apart from the activities of other countries. At the international level, the United States has played a leading role in shaping an essentially benign and passive mechanism within ITU for allocating radio spectrum to certain specified purposes, and assuring spectrum users the right to operate free from harmful interference by others.

WARC-79 and related international conferences and meetings demonstrate conclusively that contention for access to the radio spectrum and its important collateral element, the geostationary orbit for communication satellites, presents new and urgent challenges to vital U.S. national interests. The growing differences among nations over the use of the radio spectrum and related satellite orbit capacity are reflected in the Final Acts of WARC-79. From the U.S. standpoint, the results of WARC-79 are mixed.

Given the complexities of spectrum management in a changing world environment and the increased importance of telecommunication to both developed and developing nations, it is highly unlikely that traditional U.S. approaches to these issues will be sufficient to protect U.S. vital interests in the future.

Principal Findings

The most significant findings of the OTA study are the following:

1. There is an urgent need for higher level attention to Government policy coordination and accountability for international telecommunication issues generally and for spectrum management issues and international negotiations specifically.

2. Streamlined processes, coordinated Government policies, and sufficient resources on a continuing basis are essential to effective and timely preparation for the several major international conferences of ITU now scheduled to occur over the next 7 years.
3. New U.S. approaches are necessary to address radio spectrum and related satellite orbit issues in a changing world environment. Solutions to satellite orbit allocation and spectrum reallocation issues as envisioned by the Third World nations require strategies not yet developed or tested.
4. WARC-79 resulted in the loss of some U.S. flexibility in certain key spectrum areas—particularly those affecting national defense—and enhanced opportunities in many other areas.
5. Operating costs will increase for certain radio services; interference protection will become less certain; and administrative costs will need to rise to adequately implement WARC-79 decisions and prepare for future radio conferences.

General Observations and Trends

• The world environment for telecommunications has changed significantly in recent years; two-thirds of the 155 member nations of ITU can be classified as developing or Third World countries. There were 65 nations and seven groups of colonies present at the 1947 Atlantic City Conference, 80 nations and five groups of colonies at the 1959 WARC, and 142 nations (no colonies) at WARC-79.

• There are basic differences between the United States and Third World countries over the principles that should govern the allocation and use of the radio spectrum and related satellite orbit capacity. There is increasing need to identify and assess options to reconcile the sometimes sharply divergent goals of developing and developed countries.

• Third World countries are increasingly able to influence and shape international communication policies in international forums.

• The United States must maintain its technological leadership and expand its influence if future actions in a "one-nation, one-vote" forum like ITU are to be favorable to U.S. positions.

• There has been a gradual shift toward recognizing the legitimacy of nontechnical factors such as political and cultural interests and values in ITU deliberations and in other international forums.

• U.S. requirements for access to the frequency spectrum and geostationary satellite orbit locations are expanding with the explosive growth in telecommunication/information technology, the growing use of satellites, and the increasing dependence on radio and satellites for military and national security purposes.

- The disparity between nations in their ability to use the spectrum is growing; this leads to growing disagreement over the allocation and use of specific frequency bands for specific services.

- Spectrum decisions arrived at as a result of voting within ITU, as opposed to the commonly practiced consensus approach, will tend to be increasingly adverse to the United States.

- International telecommunication development is entering a phase in which regional and domestic needs and policies will predominate, as opposed to more general global facilities expansion. The thrust will be on intraregional communications and the development or enhancement of interregional communication routes.

U.S. Policymaking Structure and Processes for Spectrum Management and International Strategies

Need for High-Level Government Policy Coordination and Accountability

- The responsibility for spectrum management and policymaking is divided among several Federal agencies with coordination conducted on a structured, but often informal basis, without clear responsibility and accountability for policy at a high level of Government.

- The United States does not have a consistent and coordinated national telecommunication policy because of a lack of appreciation and concern at the top levels of Government and industry, a lack of high-level policy coordination for international telecommunication negotiations, and a failure to assign sufficient importance to international telecommunication matters, including spectrum management.

- The United States is not adequately equipped to provide comprehensive assessments required to effectively plan for the future use of the radio spectrum, to forecast future requirements, to assess the costs and benefits of shifts to new technology, or to evaluate alternative strategies to deal with international issues regarding allocation and use of the radio spectrum and geostationary orbit.

- Within the U.S. telecomunications industry there has been significant growth and change over the past 15 years that have produced more competing domestic interests with conflicting demands for spectrum use.

- The U.S. permanent spectrum management analytical mechanisms are not adequately equipped to review and verify all the stated requirements of Government and nongovernment spectrum users and to adjust needs consistent with national policy objectives. The United States lacks an effective ongoing means of collecting data and

developing and adjusting guidelines to evaluate the merits of one spectrum use over any other.

- The State Department's International Communications Policy Office is not at a high enough level in the Department's organization to prepare adequately for all the important up-coming international conferences of ITU and make its influence felt in the upper echelons of Government and industry.

- Experts warn that lack of high-level concern has led to a shortage of trained and experienced spectrum management personnel to replace those retiring from Federal Government service; there has been insufficient attention to the need for personnel with supplementary diplomatic, language, negotiating, economic, and legal skills.

- The rather general wording of Executive Order No. 12046 establishing the National Telecommunications and Information Administration (NTIA) leaves it ambiguous as to how far NTIA can go in its coordinating role with respect to U.S. international telecommunications policy, particularly when that mandate risks encroachment on the general regulatory responsibilities of the Federal Communications Commission.

- The schedule of 10 major international conferences over the next 7 years to consider a number of issues vital to U.S. interests underscores our concern that the United States reform its policymaking mechanisms and streamline the cumbersome and time-consuming procedures for developing U.S. proposals for international telecommunication conferences.

- A mechanism is needed for collecting and evaluating information on the perceived needs of other nations for spectrum and orbit resources.

Need for New Strategies To Address Spectrum and Related Satellite Orbit Issues

- ITU is a political organization that performs both political and technical functions. However, while there is a primarily technical focus for most ITU activities, there has been a gradual shift toward recognizing the legitimacy of nontechnical factors, such as political and cultural interests and values. The United States must recognize this shift and develop strategies to use its technology more broadly as a tool for resolving international issues that are not subject to technical solutions.

- The success of ITU has been due in large measure to the willingness of its members to adhere voluntarily to commonly arrived at agreements and regulations. The inherent flexibility in ITU processes has also enhanced its effectiveness. Reservations and footnotes offer escape for individual countries from disagreeable decisions of

the majority. However, excessive use of these exceptions by a sufficient number of countries—or by a few large users—serves to reduce the value of the agreements and regulations for all users.

- Many of the nontechnical issues raised in ITU—like those concerning reallocation of spectrum and guaranteed access to the geostationary satellite orbit—are among the many issues raised by Third World countries in other international forums under the principles propounded by the New World economic order and New World information order.

- Developing countries will continue to seek changes in the existing mechanism for vesting rights in the use of frequencies and access to the geostationary orbit. They seek a shift away from the current notification and coordination procedure on a "first-come, first-served" basis, toward a negotiated plan developed on an a priori basis.

- Third World countries are likely to resist drastic changes in ITU rules and procedures that operate on the principle of "one-nation, one-vote" and that provide them with increasing influence and power. They will continue to seek technical assistance from the developed countries while pursuing ITU policies favorable to their own interests.

- Third World countries will continue to advocate changes in rules and procedures that help guarantee their access to the spectrum and geostationary satellite orbit. They do not wish to rely on the "good efforts," promises, and technical ability of the developed countries to "engineer-in" future systems on a case-by-case basis, as needed.

- WARC-79 showed the increasing influence of the Third World as a political force in ITU. The struggle for influence between the developed and developing nations will continue at future ITU conferences. At the present time, the developing countries derive their power from their collective numbers; the developed countries from their technical competence, know-how, and leadership. The influence of the developing countries can most effectively be exploited in ITU legislative forums; the developed nations' through ITU technical administrative organs.

- The preeminence of U.S technological leadership and technical ability served the United States well in international spectrum negotiations when decisions were primarily based on technical matters, but more and more U.S. problems with other countries involving the radio spectrum are influenced by political and economic considerations.

- The developed countries are expanding their use of spectrum to higher frequency bands as lower, more economical, bands become congested. They rely on technology to provide solutions to problems of accommodating new demands in the future. It is becoming increasingly difficult for the developing countries to accept the proposition that they will have access to spectrum on an interference-free basis at some future date as their needs materialize.

- Certain U.S. spectrum requirements (e.g., for military radars) are not of interest to the majority of other countries. The difficulty that faces the United States in seeking to convince a majority of the 154 other ITU member countries to adopt regulations that accommodate U.S. radars in conflict with other possible uses by other countries is real and was demonstrated at WARC-79.

- Frequencies and satellite locations allocated to individual nations are not vested indefinitely under current ITU procedures, and changes in operating parameters require recoordination and registration. This creates uncertainty for present satellite system operators. The risks may increase that spectrum and orbit will not be available to provide for continuity of service from the present to the next generation of satellites.

- The growing lack of agreement among nations over which specific frequency bands should be allocated for which specific ITU radio service classification (e.g., radiolocation, fixed-satellite, broadcasting) strongly suggests that mechanisms other than service classifications should be examined.

The Impacts of WARC-79

The specific consequence of WARC-79 decisions on U.S. interests regarding particular services can best be treated in terms of how the conference dealt with specific technical issues created by some significant trends in telecommunications. These trends include the following:

- The increasing demand for high frequency (HF) spectrum by the more developed countries to meet maritime and international broadcasting needs conflicts with the desires of the less developed countries to use HF for inexpensive domestic communications. The reduction in the use of HF (3 to 30 MHz) by international fixed point-to-point operations as satellite and cable use expands is not sufficient to offset this increasing demand.

- The rapid growth in very high frequency (VHF) (30 to 300 MHz) and ultrahigh frequency (UHF) (300 to 3000 MHz) land-mobile operations in the face of continuing vital U.S. military require-

ments, and the heavy use of these bands for TV broadcasting, now necessitates greater sharing of frequencies, e.g., by radiolocation-sharing with radionavigation and with other services, and by land-mobile sharing with TV broadcasting.

- There has been rapid growth of both domestic and international fixed satellite requirements in the super high frequency (SHF) (3 to 30 GHz) spectrum coupled with growth in microwave radio relay, space research, and Earth-exploration satellite services, and the continuing need to protect important radioastronomy operations. These requirements are being pressured by new demands to accommodate mobile, navigation, and broadcasting satellites (and their feeder links) in increasingly crowded orbits. Most of these satellite spectrum uses have military as well as civil applications. In addition, there is the continuing use of the SHF spectrum for terrestrial systems.

The actions of WARC-79 with respect to these operational trends, and the technical issues they raised, either closely reflected U.S. proposals or were acceptable to the United States with certain important exceptions. However, this judgment hardly does justice to the overall results of WARC-79, particularly the future implications to the United States. **The long-term trends may be running against the United States in the sense that more problems without apparent solutions are foreseen. The United States finds itself increasingly in a defensive mode, trying to minimize losses rather than seeking significant changes to improve its long-term posture.**

There is a significiant difference between the approach advocated by the United States for using the geostationary satellite orbit and any rigid a priori allotment and planning approach that may be advocated by some developing nations. The United States, as well as many other countries, has consistently favored a flexible approach that assigns orbit locations and satellite frequencies on a case-by-case basis, often referred to as "first-come first-served." The U.S. approach seeks to accommodate needs as required and relies, at least in part, on technological advancements and good engineering practices to "engineer-in" the next satellite and accommodate all users. Such an approach is consistent with existing practice under ITU procedures for the notification, coordination, and assignment of radiofrequencies generally.

Many developing countries, on the other hand, see a detailed negotiated plan that assigns specific frequency channels and orbital positions to each country under a rigid a priori allotment plan as a means to guarantee them future access. This approach does not depend upon advances in technology or new engineering techniques to assure

accommodation of newcomers, but neither does it take into account technological improvements that might accommodate growing requirements. The developed countries already have the economic and technological means of launching and utilizing domestic satellite systems; most developing countries do not, even though many do make use of joint-user systems like the International Telecommunications Satellite Organization (INTELSAT) global satellite system. The developing nations are concerned that as the "later comers" to ITU (hence later served) there will be little or no way to accommodate their domestic requirements.

Both a posteriori (the case-by-case approach usually relying on a notice and recordation procedure) and a priori (the collective subdivision approach usually relying on a negotiated plan) have won past acceptance at conferences of ITU. Over the last 75 years one or the other approach has been advocated and used by nearly all nations to allocate spectrum, both internally and internationally. On a domestic level, the a posteriori approach is often coupled with an adjudication procedure for deciding among competing applicants, as is the case in the United States. On the international level, adjudication is almost impossible because of sovereignty claims. Most nations have been unwilling to allow an international body to determine whether they can or cannot use a radio channel or satellite position. Where channels become limited, the recourse in the recent past has been to adopt an a priori method. However, for the allocation of radio bands and services, like the fixed-satellite service (FSS), which are affected by rapidly changing technology, or which are fraught with political controversy, a priori methods tend to promote too rigid technical specifications or exaggerated claims for channels. **Much of the controversy at WARC-79, and likely to emerge at future conferences, arises from the question of the appropriate administrative arrangements to determine rights to the use of frequencies free from harmful interference.**

The adoption of the space planning conference resolution is a vigorous reminder that the effective management of orbit and spectrum utilization on both a worldwide and a regional basis is a continuing process that is becoming increasingly more difficult and complex. The achievement of U.S. objectives at ITU conferences is no longer a matter of reaching painstaking agreement on technical solutions to problems of frequency coordination and multiple usage of spectrum. It will also require sophisticated, political negotiations; imaginative, innovative approaches; and long, hard bargaining.

No immediate changes in operations using the radio spectrum or geostationary satellite orbit are required in the United States as a result of WARC-79. However, there are longer range impacts that require prompt attention: increased operating costs, reduced operating flexibility, uncertainty surrounding important pending issues, and the need for thorough preparations to address issues at future conferences.

There is no immediate cost impact imposed by WARC-79 regarding national security systems, largely because of the frequency flexibility of existing U.S. equipment, the success of the U.S. delegation at WARC, and reservations taken by the United States to counter adverse conference decisions. However, there will be future undetermined costs associated with frequency management, the development and procurement of more sophisticated equipment, compatibility studies, and coordination to prevent interference with competing users of the spectrum.

Department of Defense (DOD) interests were impacted by losses of exclusivity for radiolocation (radar) operations and by increased sharing with other services in many of the radiolocation bands. For example, demands that radar operations be discontinued in certain bands to accommodate expanded FSS operations led to considerable acrimony, which was only eased by a nonbinding U.S. commitment in a formal declaration to try to accommodate FSS in those bands. The status of radiolocation was retained but the pressure from competing fixed-satellite interests will certainly continue.

U.S. objectives for the fixed-satellite service and the mobile-satellite service (MSS), including DOD airborne, shipborne, and ground-transportable Earth station systems, were achieved in large measure. Significant amounts of spectrum were added to allocations of the FSS and no operational or economic dislocations were imposed on any existing FSS system. No major burden appears to be placed on the U.S. Government or private operating entities in complying with the decisions of WARC-79 regarding FSS. However, the differences between the United States and many developing countries over approaches to use of the geostationary satellite orbit, to be resolved by future conferences, leaves the impact on FSS uncertain.

The U.S. objective to maintain the status quo for MSS in the 235- to 399.9-MHz band used for U.S. Naval Fleet satellite communications was partially achieved; however, coordination provisions (article N13A) were added which included a condition that stations in MSS not cause harmful interference to those of other services operating, or planned to be operated, in accordance with the table of allocations. The United States found this condition unacceptable, and together with most of its North Atlantic Treaty Organization (NATO) allies entered a formal reservation in the final protocol.

While WARC-79 largely eliminated frequency-sharing between FSS and the broadcasting-satellite service (BSS) in the Americas, the latter must now share frequencies with the terrestrial fixed service, including private microwave systems widely used in the United States. This sharing could result in interference to BSS Earth station receivers operating in the same area as fixed station transmitters. The private microwave users are concerned that sharing with direct-broadcasting satellites is not feasible and that they may be forced to vacate the band.

A U.S. objective at WARC-79 was to gain more frequency allocations for HF broadcasting (e.g., the Voice of America). This could only be done at the expense of the fixed service and was therefore opposed by many developing countries that use HF, shortwave radio for internal domestic communications. The HF broadcasting allocations were increased conditioned on the successful outcome of a specialized HF broadcasting conference to be held in the mid-1980's to "plan" for more efficient and equitable use of the broadcasting bands. While the conference agenda will be relatively broad and open, it was apparent at WARC-79 that the United States and the developing countries have significant differences as to the type of planning to be undertaken.

Improving U.S. Spectrum Management and Preparation for International Telecommunication Conferences

Consistent with the findings of past study commissions and task forces going back to 1950, this study finds that the present U.S. Government structure for spectrum management and participation in international telecommunication conferences is inadequate. Primarily, the problems stem from the absence of high-level Government attention to effective policy development and coordination on a consistent and continuing basis with centralized accountability.

At least four options are available to Congress in addressing this issue: 1) maintain the status quo and make no changes; 2) maintain the present structure, but raise the level of attention and accountability within the responsible agencies; 3) establish a mechanism—such as a task force of high-level Government officials—to develop, examine, and make recommendations on structural and procedural improvements, or; 4) establish a permanent board, council, or interagency committee of high-level Government officials to be responsible and accountable for international telecommunication policy coordination and the preparations for international conferences.

Certain shortcomings in spectrum management could be corrected without any fundamental change in the structure of FCC or NTIA. Assigning spectrum management a higher priority, particularly within FCC, and using resources more efficiently would make a significant difference. For example, FCC could improve its data base for spectrum management with the help of its own computer and spectrum experts.

The validation of spectrum requirements, and the apportioning of spectrum between Government and nongovernment users, needs closer scrutiny. A mechanism using analytical tools to help evaluate needs and assess priorities among competing users of the spectrum would provide decisionmakers with basic information and data for

use in establishing policies and reviewing requirements. While Federal spectrum requirements are reviewed by the Interdepartment Radio Advisory Committee and its Spectrum Planning Subcommittee, this function needs to be strengthened and broadened to effectively consider longer range impacts.

There have been problems in the timely formation of U S. delegations for ITU conferences arising from the need for the early inclusion of experts from industry and other nongovernment organizations. Preparations for international telecommunications conferences could be improved by replacing the ad hoc approach with an ongoing conference preparatory structure with a focal point for high-level responsibility and accountability and involving all the concerned Government and nongovernment telecommunication interests. These problems could be addressed and the effectiveness of U.S. participation in international telecommunications meetings improved by the following additional steps:

1. Industry and other nongovernment delegates could again be permitted to participate fully as U.S. representatives at international telecommunication conferences and take any assignments on the delegation for which their skills and experience qualify them. Legislation to accomplish this passed both Houses of the 96th Congress and was ultimately vetoed by the President for reasons unrelated to the exemption.
2. Consideration could be given to finding means to comply with due process requirements under the Administrative Procedures Act and still name industry and other nongovernment representatives to delegations on a timely basis.
3. Guidelines and implementing mechanisms could be established for naming the chairman and individual members of U.S. delegations. The qualifications required, the distribution of skills needed, and type of representation desired could be determined at an early stage of conference preparation. Individuals chosen to serve on the delegation could be selected from the best candidates available, especially those who participated in the preparatory effort. Whatever special Government assistance is required to assure particular representation could be made available in the early stages of conference preparations.

U.S. Strategies for Dealing With International Spectrum Issues and ITU

The ITU structure, which was well suited to the analysis of interference between radio communication systems, and to achieving a consensus on noncontroversial matters among a small number of broader issues, is sorely tested by the demands of numerous countries exhibiting the widest possible range of technical, economic, cul-

tural, and political backgrounds. An organization that has traditionally been concerned with technical and operating standards for radio equipment and administrative mechanisms that give a country the right to operate radio stations free from harmful interference from others is being asked to satisfy the demands of developing countries for "guaranteed access" to an equitable share of the radio spectrum and satellite locations that many of them have no immediate capacity to use.

It is increasingly questionable whether U.S. negotiating skills and technological proficiency can secure essential U.S. goals and objectives in a forum that employs a "one-nation, one-vote" decisionmaking formula and in which the United States and the other industrial countries are greatly outnumbered by the less industrialized member countries.

From a strategic standpoint, the United States has a wide range of options. At one extreme, the United States could conclude that the drawbacks of continued participation in ITU outweigh the benefits, and withdraw from the organization or decline to participate in its deliberations. At the other extreme, the United States could decide to avoid controversy within ITU and simply yield to other nations on controversial matters. Between these extremes are a number of alternatives.

From a structural standpoint, assuming that ITU can be changed, a number of options may be available. The United States could seek to revise the voting formula of ITU to one more fair to the United States, perhaps by giving added voting weight to those countries that contribute most heavily to the United Nations budget. A more modest proposal would be to increase the number of ITU regions beyond the present three so that regional issues could be dealt with by a smaller number of countries most directly concerned.

Withdrawal From ITU

Would withdrawing from ITU guarantee the United States unhindered use of the spectrum allocation or frequency assignments the United States needs? Probably not. ITU members rely on the organization to avoid interference from the radio signals of others and to achieve interoperability of certain mutually used systems, such as radionavigation. The assignment of a particular frequency is of little value if others feel free to use it for purposes that cause interference. There are no effective international sanctions to force compliance with ITU decisions. Therefore, the United States relies, as do all nations, on the voluntary agreement and cooperation of other nations to refrain from interfering with its use of the spectrum.

For applications that are vulnerable to interference, U.S. preemption of spectrum (i.e., use what we wish to use) would be ineffective because any nation that chose to interfere, whether for a valid need or

by intentional jamming, could greatly reduce the value to the United States of the preempted spectrum. Any preemption for uses that were invulnerable to interference (e.g., high-power radar systems with electronic countermeasure capacity) would likely result in retaliation by other nations in areas where the United States is vulnerable.

It is conceivable that the United States could abandon ITU and establish a more congenial grouping of developed countries as a forum for coordination to avoid radio interference, and simply ignore other countries. Coordination and information exchange would become less certain, but still fairly effective. The lack of a central spectrum allocation and coordination authority with global participation would probably lead to a more fragmented use of the spectrum and less standardization.

Revised ITU Voting Formula

As an option less drastic than withdrawal from ITU, the United States might join with other industrial nations to force a revision of the ITU's "one-nation, one-vote" decisionmaking formula toward one that would reflect the dominance of these nations in the actual use of the spectrum. If successful, this option would greatly reduce the ability of the Third World nations to block or force changes in U.S. positions.

A revised voting formula might reduce the contention over spectrum allocation matters at ITU; make ITU more efficient; help to make spectrum use more efficient by precluding the adoption of unworkable allocation schemes; and be no less fair than the voting practices used in a number of other international bodies that benefit Third World nations without being controlled by them. It may not be necessary that the proposed change in voting arrangements apply to all ITU spectrum decisions. The stimulus for concurrence of Third World nations with such a proposal would be the possibility that, were it rejected, the developed countries might withdraw from ITU and render it essentially irrelevant.

The reaction of Third World nations is difficult to predict, but it seems most likely that they would bitterly resist any reversal of their recent successful trend toward fuller participation and refuse to make any concession on ITU voting formulas.

Increased Regionalization of ITU

At present, ITU divides the world into three geographic regions and many issues that can be treated separately and effectively in a single region are considered in this way. (Region 1 covers Europe, the U.S.S.R., Turkey, Mongolia, and Africa. Region 2 covers North, Central, and South Americas, the Caribbean, and Greenland. Region 3 covers South Asia, Australia, New Zealand, and the Pacific.) Region-

al administrative radio conferences are scheduled on a variety of specific issues, allowing WARCs to "spinoff" certain controversial matters. One option would be to extend this process of regionalization on a geographic basis to smaller subregions, and/or on an issue basis to include only those nations directly affected by the particular issue. The purpose would be to reduce the number of nations debating or voting on issues that do not affect them directly, thus reducing unnecessary contention.

WARC-79 was attended by 142 nations. Approximately 1,670 delegates and advisors met for 11 weeks and considered nearly 17,000 proposals (more than 900 from the United States), and held more than 900 meetings. Surely any approach that might help limit further WARCs to more modest proportions would be worthy of study. Large meetings also tend to encourage bloc voting, which has already begun to emerge at ITU. Thus, subdividing ITU into smaller units, either on the basis of geographic subregions or on the basis of particular issues, would divide the Third World bloc into smaller, less dominant groups.

The mechanics and economics of increasing substantially the number of conferences is also important to consider. The limited U.S. professional staff available to prepare for and attend spectrum conferences is already stretched thin, and if the United States does not wish simply to skip many of the meetings—a risky proposition—this staff would need to be considerably augmented. The developing countries would find it even more difficult to prepare for a heavy schedule of meetings.

Increased decentralization of ITU could, in principle, lead to greater fragmentation in the use of the spectrum, with the same bands being used for different purposes in different regions to a much greater extent than is now the case. While this may be acceptable in the short run, the long-term implications are worthy of study.

Better Coordination and Planning

As a relatively conciliatory approach, the United States could mount a major effort to develop long-term plans for spectrum use that would take into account the spectrum requirements of developing nations, to aid them in understanding the realistic options available to meet their short- and long-term needs, to offer such technical and economic assistance as might be needed to enable them to participate actively in the planning process, and to seek their concurrence with fair, objective, and realistic proposals.

To a significant extent, the confrontations initiated by Third World nations in ITU are based on suspicion and mistrust of developed countries. Perhaps this is based on a lack of understanding of the true potential of technology to create the spectrum resources they will need in the future. But many Third World nations also question

whether they will be able to take advantage of that technology and they question the good faith of the developed countries to share the benefits of advanced technology.

The fact remains that there is adequate spectrum for all nations at the present and that technology will very likely expand the effective utility of the available spectrum to satisfy future needs. The problem for the United States is to convince other nations, particularly the developing countries, that spectrum and orbit capacity will be available and that their needs for service can be satisfied.

Long-range planning of spectrum utilization is presently inadequate and not easily accomplished in an area where technological rate of change is rapid and in a competitive system like that in the United States where policymakers are more likely to be responding to problems than to be developing long-range plans. However, better long-range planning for telecommunication services and spectrum needs is clearly necessary to cope effectively with the ITU allocation process.

It is also necessary to know the extent to which developing countries' positions at ITU are based on their own vital interests rather than on misunderstandings and politics; it is unlikely that they would compromise vital interests for the sake of comity. A cooperative planning process would tend to expose true interests and clarify the negotiations.

As a practical matter, the majority of the developing countries cannot now make use of advanced communications technology without technical and economic assistance from technologically advanced countries. If the majority of nations were to vote to adopt rules that limit or preclude the use of advanced technology to which they do not have independent access, communication capability would suffer and costs would increase in the long term for all users. Thus, the cost of assisting other countries in using advanced technology must be balanced against the cost to the United States of not being able to take full advantage of such technology ourselves. This equation deserves close analysis.

Cooperative planning has worked in the past; the United States was a leader in cooperative planning for INTELSAT and the International Maritime Satellite Organization (INMARSAT). The exact mechanism for cooperative planning is an important and complex matter, made more difficult by divided responsibility in the United States for communications policy in general and spectrum planning in particular. However, it should be possible to graft onto the existing structure a sufficiently comprehensive mechanism with high-level responsibility to assure effective long-range planning and to foster cooperation with other nations.

As an alternative, ITU could be invested with a planning staff to undertake long-range coordination, analysis, and planning. Such a "neutral" planning expertise might be less likely to be mistrusted by

Third World nations, and perhaps more capable of defusing potential disagreements. Naturally, the United States would participate in the process and perhaps may more easily influence a planning process in which the measure of power is technical expertise, rather than influence an ITU conference in which the measure of power is votes. The United States has consistently opposed any increase in the power of ITU, particularly efforts to expand the planning role of the International Frequency Registration Board.

A broader, more extensive, and more conciliatory approach to international spectrum planning would be required under this option and could have a real chance of success, given some major changes in the U.S. approach. In the long run it could be the least expensive and most effective option available to this country.

Common-User System

As an alternative to contention for satellite slots on the geostationary orbit, the United States and other developed countries could enter into a joint venture with developing countries to construct, launch, and operate a common satellite system to meet domestic needs for telecommunication and/or broadcast services. The developed nations would provide the private capital and technological resources necessary to construct and launch the system, and would operate and manage it in conjunction with other using nations. All nations in the joint venture would have the option of purchasing a share of the common enterprise, up to their actual percentage of use of the system, and sharing proportionately in any profits. Such an arrangement would be similar to that governing the INTELSAT global satellite system used for international telecommunications. High-capacity satellite systems employing technology to make a common-user system economic and operationally attractive to developing countries for domestic services could be part of the existing INTELSAT structure or a separate structure established for this purpose.

Many developing nations are concerned that the satellite orbit locations are being occupied rapidly on a "first-come, first-served" basis, and that by the time they are in a position to use satellite systems there will be no desirable orbit locations left for them. It seems clear that the requirements of developing countries will be for satellite service and not for satellite orbit locations that they may not be able to use. This option would provide service without allocating dedicated orbit locations for individual users.

Moreover, the cost of developing and launching a dedicated satellite system is very high, well beyond the capability of most developing countries for the foreseeable future. This option could provide satellite service well in advance of the time these countries could afford their own systems, and much more cheaply. No large initial capital investment would be required from user nations, and there would be little risk.

While this policy option does not address the full range of problems before ITU, it does offer the prospect of relieving the pressure on a particularly important and contentious issue. If low cost and technically attractive domestic satellite capacity is made available through an international organization that accommodates the sovereignty interests of each country, many developing countries could come to see access to orbital slots and satellite frequencies as a side issue with availability of service being the main objective.

A common-user system need not require any Government funding by the United States. Sufficient capital and technical resources exist in the private sector in the United States, and within Europe and Japan, to construct such a system as a commercial venture with expectations of future markets for follow-on equipment and services. Alternatively, such systems could conceivably be initiated with World Bank loan guarantees.

"A Priori" Allotment

The United States could agree to participate with other nations in the development of a long-range plan for the utilization of satellite orbit locations to serve participating nations' domestic communications requirements. This plan would assure that orbital slots would be available for the use of all nations when needed. In exchange for this agreement, the developed nations would likely insist that the plan be based on sound operating principles and be updated regularly to take account of the latest, most efficient technology available.

A priori allotment of satellite orbit slots has been a cause celebre among developing countries. At WARC-79, a resolution was adopted to consider this issue at a two-part space planning WARC in the mid-1980's. The United States has opposed a priori allotment plans for satellite service as wasteful and inhibiting to technological advancement. Although this option goes a long way toward accommodating the position of the developing countries, it maintains a substantial degree of flexibility important to the United States, including the key qualification of a requirement for regular technological updating that would help to avoid the worst consequences associated with rigid allotment schemes.

As far as the United States is concerned, certain types of a priori allotment plans would not be as objectionable as others. Plans based on sound engineering and operational parameters might be workable internationally, at least on a regional basis. Indeed, U.S. domestic satellite operations are based more or less on an a priori approach.

In addition to the possible advantages that may result from improvements in technology, there are two factors that may help reduce the impact of a priori allotment plans on the United States. One is advanced technology, including cellular satellite technology, already on the drawing boards, which will permit the construction of a large,

wideband satellite that can provide very large capacity from a single orbit slot. The other factor is the particular geography of region 2 (North and South America). From the standpoint of using the geostationary satellite orbit, region 2 is naturally divided into two parts—those nations located in the Northern Hemisphere and those in the Southern Hemisphere. A second geographic factor that serves to separate the hemispheres is the displacement in longitude of the nations in the Northern and Southern Hemispheres. Also, those nations closer to the Equator enjoy the widest possible visibility of the orbit and have the greatest flexibility in positioning satellites. Moreover, the North American Continent consists of three countries with very large land areas that made the use of advanced technology using shaped-beam antennas attractive.

There may even be some benefits to the United States from adopting an a priori allotment plan. At present, there is considerable uncertainty about the outcome of the 1983 Region 2 Broadcasting Satellite Administrative Radio Conference and the space planning conferences in the mid-1980's. If a decision is postponed, the uncertainty would continue. A situation would then be perpetuated in which any existing domestic satellite orbit slot may be withdrawn in the future. Moreover, no satellite system designer could plan the logical evolution of a proposed system with confidence that the required additional allotments would be available. This would force designers to plan their systems on the basis of short-term recovery of investment.

It is also important to examine the tactical aspects of agreeing to an a priori allotment policy. By participating in the development of a plan, the United States would be in a position to influence the type of plan adopted and possibly gain concessions on other issues of importance to the United States.

U.S. Options Regarding the Final Acts of WARC-79

As the largest and most technically advanced user of the radio spectrum on a worldwide basis, the United States approached WARC-79 with the greatest stake in reaching agreement on a new table of frequency allocations and a revised set of related technical and administrative regulations.

While the Department of State has indicated official U.S. satisfaction with the outcome of WARC-79, the United States ultimately took six reservations in the final protocol to the Final Acts of WARC-79, helping to bring the overall total to 83. Two of the six were directed at political issues, but the remaining four were directed at decisions that could have a direct impact on U.S. telecommunications operations.

The Final Acts of WARC-79 will ultimately come before the U.S. Senate to be considered for ratification as a treaty. There are several options available:

1. **The United States can ratify the Final Acts without delay.** The Final Acts constitute the "radio regulations, Geneva, 1979," which replace the 1959 regulations as partially revised by the administrative radio conferences held in 1963, 1966, 1971, 1974, and 1978. The Final Acts also incorporate the provisions of the 1977 broadcast satellite WARC as modified by WARC-79.
2. **The United States can ratify the Final Acts with conditions, thereby underscoring and making explicit the reservations taken at Geneva.**
3. **The United States can ratify the Final Acts with additional reservations** that either state U.S. refusal to acquiesce to particular decisions taken at WARC-79, beyond those cited in earlier U.S. protocol statements, or set forth U.S. policy with respect to future actions by ITU or specific implementation of the WARC-79 Final Acts.
4. **The United States can ratify the Final Acts in part,** specifically withholding ratification of those provisions (which would have to be listed in precise detail) where the United States chooses to remain bound by the provisions of existing regulations previously ratified (which would also have to be listed in precise detail).
5. **The United States can withhold ratification of the Final Acts pending the outcome of several important international conferences dealing with telecommunications issues.** This would deny FCC and the current administration any legal basis for implementing decisions taken at WARC-79, many of which were strongly advocated by the United States and fought for by the U.S. delegation and which are scheduled for implementation by other ITU members on January 1, 1982. The most immediate international telecommunications conference of great importance to the United States is the September 1982 plenipotentiary. The actions taken at this conference to revise the ITU convention will be basic to all future conferences of ITU.
6. **The United States can reject the Final Acts of WARC-79 in their entirety** and announce that we intend to abide by the preexisting radio regulations, as amended. The consequences would be similar to those cited above.

NOTE: Copies of the full report "Radiofrequency Use and Management: Impacts From the World Administrative Radio Conference of 1979" can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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